CLAIMS

1. A method of repairing a defect area of a lithography mask using a focused ion beam having a beam diameter, the method comprising:

directing the focused ion beam toward first pixel locations in the defect area, the first pixel location being separated by a first distance that is greater than the beam diameter; and

directing the focused ion beam toward second pixel locations in the defect area, the second pixel locations being separated by a second distance, the second distance being less than the first distance and sufficiently small to produce a substantially flat surface.

2. The method of claim 1 further comprising directing a gas toward the defect area while directing the focused ion beam toward the second locations.

3. The method of claim 1 in which directing a gas toward the defect area includes directing a gas comprising bromine.

4. The method of claim 1 in which the first distance is greater than 1.5 times the beam diameter and less than fifteen times the beam diameter.

5. The method of claim 1 in which the first pixel locations do not extend to the edge of the defect area and the second pixel locations do extend to the edge of the defect area.

6. The method of claim 1 in which the defect area has an original thickness before milling, and in which directing the focused ion beam toward first pixel locations within the defect area includes directing the focused ion beam toward first pixel locations to remove material representing between fifty percent and ninety five percent of the original thickness.

7. The method of claim 6 in which removing material representing between fifty percent and ninety five percent of the original thickness includes removing material between seventy and ninety percent of the original thickness.

8. The method of claim 1 in which the area comprises an interior region and a boundary region and in which directing the focused ion beam toward first pixel locations in the defect area includes directing the focused ion beam toward first pixel locations in the interior region but not the boundary region.

9. The method of claim 8 in which the boundary region has an average width of less than five times the first distance.

10. The method of claim 1 further comprising directing the focused ion beam toward additional pixel locations in the defect area, the additional pixel locations being spaced apart by a distances less than the first distance and greater than the second distance.

11. The method of claim 1 in which the defect area comprises chromium.

12. A computer readable media comprising computer instructions for carrying out the steps of claim 1.

13. A method of using a focused ion beam to remove material from an area of a substrate, comprising:

scanning an ion beam within the area to produce an uneven surface, but not within a boundary region at the edge of the area;

scanning an ion beam within the area to produce a substantially flat surface; and

directing an etch enhancing gas toward the area while scanning the ion beam to produce a substantially flat surface.

14. The method of claim 13 in which:

scanning an ion beam within the area to produce an uneven surface includes directing the focused ion beam toward first pixel locations within the area, but not within a boundary region at

the edge of but within the area, the first pixel location being separated by a first distance that is greater than the beam diameter; and

scanning an ion beam within the area to produce a substantially flat surface includes directing the focused ion beam toward second pixel locations within the area, the second pixel locations being separated by a second distance, the second distance being less than the first distance and sufficiently small to produce the substantially flat surface.

15. The method of claim 14 in which the first distance is greater than 1.5 times the beam diameter and less than fifteen times the beam diameter.

16. The method of claim 13 in which the boundary region has a width less than five time the first distance.

17. The method of claim 13 in which the material being removed has an original thickness before milling, and in which directing the focused ion beam toward first pixel locations within the area, but not within a boundary region, includes directing the focused ion beam toward first pixel locations to remove material representing between fifty percent and ninety five percent of the original thickness.

18. The method of claim 17 in which removing material representing between fifty percent and ninety five percent of the original thickness includes removing material between seventy and ninety percent of the original thickness.

19. The method of claim 13 in which the material comprises chromium, the substrate comprises quartz, and the etch enhancing gas comprises bromine.

20. A computer readable media comprising computer instructions for carrying out the steps of claim 13.

21. A focused ion beam system including:

an ion source;

an ion optical column for forming ions emitted from the ion source into a focused ion beam;

means for scanning the focused ion beam within the area, but not within a boundary region at the edge of the area, to produce an uneven surface;

means for directing the focused ion beam toward the area, including the boundary region, to produce a substantially flat surface; and

means for directing an etch enhancing gas toward the area while directing the focused ion beam toward the second pixels locations.

22. The apparatus of claim 21 in which

means for scanning the focused ion beam within the area, but not within a boundary region at the edge of the area, to produce an uneven surface includes means for directing the focused ion beam toward first pixel locations within the area, but not within a boundary region at the edge of the area, the first pixel location being separated by a first distance that is greater than the beam spot size; and

means for directing the focused ion beam toward the area, including the boundary region, to produce a substantially flat surface includes means for directing the focused ion beam toward second pixel locations within the area, the second pixel locations being separated by a second distance, the second distance being less than the first distance and sufficiently small to produce a substantially flat surface;

23. The apparatus of claim 21 in which means for directing the focused ion beam toward first pixel locations within the area, but not within a boundary region at the edge of the area

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includes means for directing the focused ion beam toward first pixel locations within the area, but not within a boundary region having a width less than five time the first distance.